

Claims: We claim:

1. A primarily organic solid-chemical composition which provides the capacity to extract and absorb hydrophobic organic and inorganic chemical contaminants from contaminated media such as wastes, soils, waters, sediments and the like via its physical, chemical and biological properties, enhances the bioavailability and biogeochemical reactivity of said contaminants, creates and maintains anaerobic and reducing conditions in said contaminated media and promotes the anaerobic biodegradation, detoxification, and/or transformation of said contaminants comprising:
 - a. A first component which constitutes 20% to 97% of said composition by weight being a source of fibrous plant tissue, organic carbon co-substrates, electron-acceptor forms of nitrogen, proteins, enzymes and other organic nutrient forms of nitrogen, phospholipids, fatty acids and other nutrient forms of phosphorus, and also being a source of inoculum for legume-related and plant-fiber degrading microorganisms and which provides the capacity to physically and/or biogeochemically extract hydrophobic contaminants from contaminated environmental media selected from one or more of the group comprising materials derived from the plant families *Leguminosae* and *Phaeophyta* [here and after component (a)];
 - b. A second component which constitutes from 3% to 80% of said composition by weight being (i) a source of fibrous plant tissue, organic carbon co-substrates, relatively water-insoluble oils and resins, organic forms of nutrient nitrogen and phosphorus, and also being a source of inoculum for plant-fiber degrading microorganisms and which provides the capacity to physically and/or biogeochemically extract hydrophobic contaminants from contaminated environmental media selected from one or more of the group comprising materials derived from the plant families *Gossypium* and *Cannabaceae* [here and after component (b)].
2. A chemical composition in accordance with Claim 1, which further includes another component which constitutes from 0.5% to 30% of said composition by weight being both an inorganic source of electron acceptors and an ammonium-free source of inorganic nutrient nitrogen for denitrifying bacteria, metal-reducing bacteria and other

anaerobic microorganisms capable of denitrification processes selected from one or more of the group comprising sodium nitrate, sodium-potassium nitrate, and potassium nitrate and any combinations thereof (here and after component c).

3. A chemical composition in accordance with Claim 1, which further includes another component which constitutes from 0.25% to 15% of said composition by weight being an inorganic source of complex, hydrolyzable forms of nutrient phosphorus for microorganisms and a source of surfactants selected from one or more of the group comprising sodium hexametaphosphate, sodium trimetaphosphate or other biologically hydrolyzable ringed metaphosphates and linear polyphosphates and any combinations thereof (here and after component d).
4. A chemical composition in accordance with Claim 1, which further includes another component which constitutes from 0.01% to 5% of said composition by weight being a source of chelating agents, acidifying agents or organic acids or any combination thereof selected from one or more of the group comprising citric acid, humic acid, fulvic acid, sodium citrate, nitrilotriacetic acid (NTA), and ethylenediaminetetraacetic acid (EDTA) and any combinations thereof (here and after component e).
5. A chemical composition in accordance with Claim 1, which further includes another component which constitutes from 0.001% to 2% of said composition by weight being a source of solid-media inoculum for microorganisms selected from one or more of the group comprising soil bacteria, metal-reducing bacteria, legume-related bacteria, plant-fiber degrading bacteria and plant-fiber degrading fungi and any combinations thereof (here and after component f).
6. A chemical composition in accordance with Claim 1, which further includes another component which constitutes from 0.5% to 30% of said composition by weight being a source of fibrous plant tissue, complex sugars, starches and other carbonaceous co-substrates, organic forms of nutrient nitrogen and phosphorus, and also being a source of inoculum for plant-fiber degrading microorganisms and which provides the capacity to physically and/or biogeochemically extract hydrophobic contaminants from contaminated environmental media selected from one or more of the group comprising

materials derived from the plant families *Triticum* and *Aegilops* (here and after component g).

7. A chemical composition in accordance with Claim 1, whereby said nitrogen-fixing plant materials comprising said component (a) of said composition are further selected from one or more of the group comprising the plant genera *Lespedeza* spp., *Medicago* spp. (e.g., alfalfa), *Vicia* spp. (e.g., vetch), *Glycine* spp. (e.g., soy), *Lathyrus* spp. (e.g., indian vetch), and *Trifolium* spp. (e.g., clovers).
8. A chemical composition in accordance with Claim 1, whereby said component (a) of said composition is further selected from the marine plant genus *Sargassum*.
9. A chemical composition in accordance with Claim 1, whereby said component (b) of said composition is selected from one or more of the group comprising cotton lint or other fibrous cotton-containing materials or wastes produced by the cultivation or processing of cotton, cotton plants and cotton seed.
10. A chemical composition in accordance with Claim 1, whereby said component (b) of said composition is selected from one or more of the group comprising fibrous plant materials or wastes produced by the cultivation or processing of hemp plants or hops plants.
11. A chemical composition in accordance with Claim 2, which further includes within said component (c) an inorganic source of electron acceptors and an ammonium-free source of inorganic nutrient nitrogen and either electron-acceptor or nutrient forms of iron and/or manganese for denitrifying bacteria, metal-reducing bacteria and other anaerobic microorganisms capable of denitrification processes selected from one or more of the group comprising ferric nitrate, manganese nitrate, manganese nitrate tetrahydrate, or manganese nitrate hexahydrate.
12. A chemical composition in accordance with Claim 5, which further includes within said component (f) of said composition inoculum for metal-reducing and oxidizing microorganisms selected from one or more of the group comprising "yellow boy" or

other biogeochemically produced ferric oxides, hydroxides and oxyhydroxides or similar products or byproducts of mine drainage wastes or the treatment thereof.

13. A chemical composition in accordance with Claim 5, whereby said component (f) of said composition includes microbial inoculum selected from one or more of the group comprising *Rhizobium* spp., *Bradyrhizobium* spp., *Fibrobacter* spp. and *Clostridium* spp., *Pseudomonas* spp., and *Geobacter* spp.
14. A chemical composition in accordance with Claim 6, whereby said component (g) of said composition is selected from one or more of the group comprising fibrous plant materials, products and wastes produced by the processing of wheat, oats, barley, and rye.
15. A chemical composition in accordance with Claims 1, 6, 7, 8, 9, 10, and 14 whereby one or more said components of said composition and any combinations thereof are in the form of one or more selected from the group comprising powders, flour, pellets, tablets, capsules, meals, mids, husks, hulls, hays and straws.
16. A chemical composition in accordance with Claim 15, whereby one or more said components of said composition and any combinations thereof are in the dehydrated, dried or freeze-dried forms.
17. A chemical composition in accordance with Claims 1 through 15, whereby one or more said components of said composition and any combinations thereof are comprised of medium-sand, fine-sand, silt- or clay-sized particles and any combinations thereof.
18. A chemical composition in accordance with Claims 1 through 17, whereby any said embodiments of said composition are in the form of pellets, tablets, capsules, or any combinations thereof.
19. A chemical composition in accordance with Claim 18, whereby any said forms of any said embodiments of said composition and any combinations thereof further include an additional component (h) comprising from 0.1% to 7% of the total composition by weight

being processing and/or binding agents selected from one or more of the group comprising additional plant-derived materials, starch, molasses, barley malt extract, corn syrup, vegetable oils, fats or lards, animal oils, fats or lards, glycerin, gelatine, bentonite, montmorillonite, kaolinite, calcium carbonate, and portland cement and any combinations thereof whereby the amounts of the other components of the said composition by weight are adjusted downward in such manner so as to maintain the relative proportions of said other components.

20. A chemical composition in accordance with Claims 1, 6, 7, 10, and 14 whereby said plant materials comprising components (a), (b) or (g) of said composition and any combinations thereof are cultivated *in-situ* within the contaminated media via the planting and growth of said plants.
21. A chemical composition in accordance with Claim 20, whereby said plant materials which are cultivated *in-situ* are subsequently overwintered *in-situ* via their exposure to one or more periods of freezing temperatures.
22. A chemical composition in accordance with Claims 1 through 21 whereby said chemical composition is supplemented with a liquid-chemical composition which contains one or more components selected from the group comprising nitrates, nitrites, phosphates, surfactants, alcohols, vegetable oils, mineral oils, corn syrup, barley malt extract, molasses, humic acids, fulvic acids and chelating agents.
23. A method in accordance with Claims 1 through 21, whereby said chemical composition is added to one or more of the group comprising contaminated, industrial or hazardous liquid and solid wastes and contaminated environmental such as soils, sediments, waters and aqueous sludges and any mixtures thereof at a dose rate in the range of 0.1 g to 1000 g per Kg of said contaminated media.

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